


Ultrasound of Wrist and Hand Pathology and Intervention

Jon A. Jacobson, MD FACR
FSRU, FAIUM, RMSK

Professor of Radiology
Lenox Hill Radiology, NYC
University of California, San Diego



Syllabus

1

Disclosures

- Consultant: Bioclinica
- Book Royalties: Elsevier
- Not relevant to this lecture

2

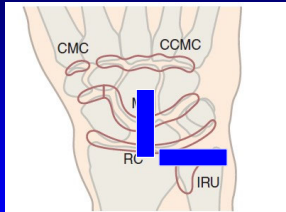
Pathology:

- Joint effusion and synovitis
- Tendon abnormalities
- Nerve entrapment
- Ligament, cartilage, and osseous injury
- Cysts and masses

3

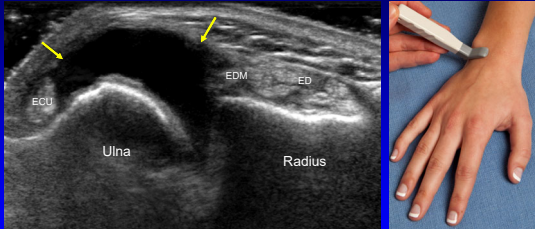

Joint Assessment: dorsal

- Wrist:
 - Radiocarpal joint (RC)
 - Midcarpal joint (MC)
 - Distal or inferior radioulnar joint (IRU)
- Hand:
 - MCP and PIP joints
 - 1st CMC (if symptomatic)



4

Joint Effusion: distal radioulnar joint

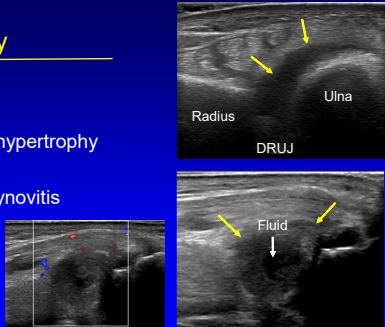



Transverse

5

Joint Effusion vs Synovial Hypertrophy

- Anechoic: fluid
- Hypoechoic:
 - Effusion vs. synovial hypertrophy
 - Compressible: fluid
 - Internal hyperemia: synovitis
 - *flow may be absent




AJR 2000; 174: 1353

6

Wrist Joints

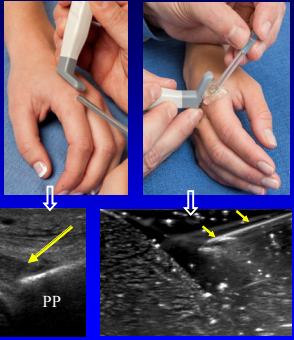
- Dorsal recesses
- In plane
- Transducer: axial
- Medial or lateral



7

MCP Joints

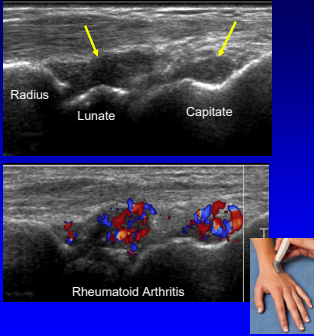
- Dorsal recesses
- In plane
- Parasagittal or transverse
- Sterile gel stand off



8

Inflammatory Arthritis: role

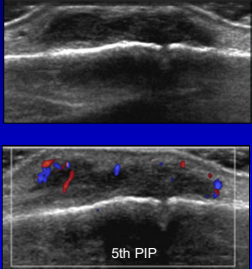
- Identify synovitis and erosions
 - Prior to initiating treatment
- Determine activity: hyperemia
- Aspirate or inject
- Follow-up after therapy
 - Decreased hyperemia
 - Decreased synovial thickness



9

Arthritis: synovitis

- Synovial locations:
 - Joint recess, bursa, tendon sheath
- Hypoechoic compared to adjacent subcutaneous fat
 - May be isoechoic or hyperechoic
- Hyperemia: variable
 - Represents activity of inflammation
 - Decreased: treatment (even NSAIDS)

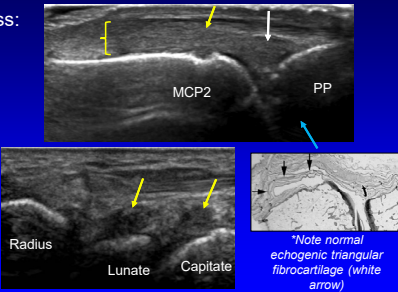


Backhaus M, Arthritis and Rheum 1999; 42:1232

10

Pitfall Alert! Normal Joint Capsule Appearance

- Dorsal capsule thickness:
 - MCP 1: 6 mm
 - MCP 2: 4 mm
 - MCP 3-5: 3 mm
 - RC joint: 4 mm
 - MC joint: 3 mm
- Do not interpret as abnormal synovial hypertrophy



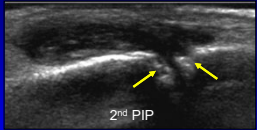
*Note normal echogenic triangular fibrocartilage (white arrow)

*Falkowski A et al. Eur J Radiology 2020; 124

11

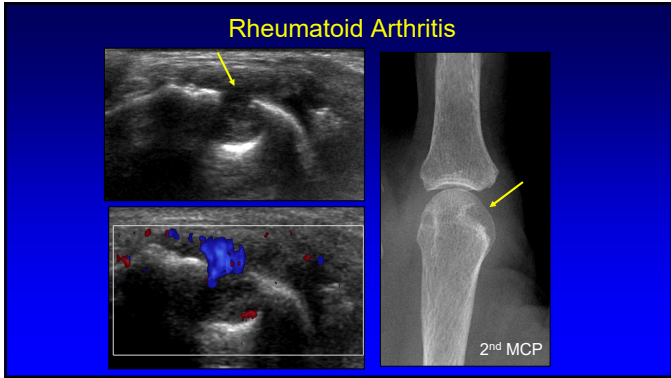
Erosions

- Disrupted cortex in 2 planes
- Ultrasound not very good for erosions:
 - Better than radiographs
 - 42% sensitivity¹, 29% false positives²: wrist/hand compared with CT
 - Very non-specific, time consuming
- Adjacent synovitis adds specificity
- Correlate with radiographs, labs, distribution

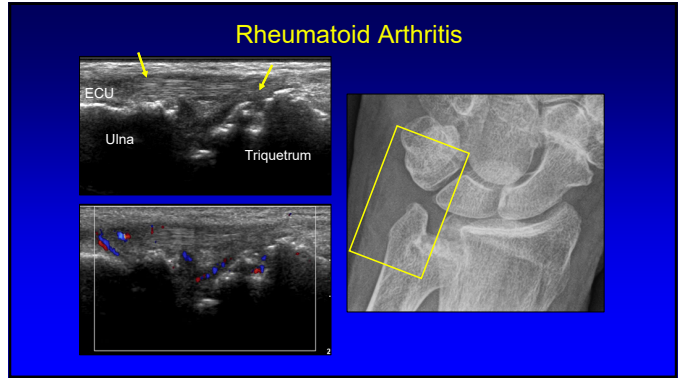


¹Dohn UF M, Arthritis Res Ther 2006; 8:1
²Finzel S. et al. Arth Rheumatism 2011; 63:1231

12



13



14

Pitfall Alert!
Pseudoerosion

- Metacarpal head: dorsal
- Up to 37% of metacarpal heads: 2nd most common
- Bare area: no hyaline cartilage
- Unlike erosion:
 - Smooth
 - Maximum depth: 2 mm
 - No adjacent synovitis

Boutry N. et al. Radiology 2004; 232:716

15

**Pseudoerosion:
dorsal metacarpal head**

Radiology 2004; 232:716

16

Pitfall Alert! Pseudoerosions Are Everywhere!

- Pseudoerosions: 100%
- Metacarpal heads: all
 - 2nd: 92%
 - 3rd: 86%
- Carpal bones:
 - Lunate: 82%
 - Triquetrum: 84%
 - Distal ulna: 22%

**Falkowski A et al. Eur J Radiology 2020; 124*

**Note lack of adjacent synovitis*

17

Pathology:

- Joint effusion and synovitis
- **Tendon abnormalities**
- Nerve entrapment
- Ligament, cartilage, and osseous injury
- Cysts and masses

18

Tenosynovitis (paratenonitis):

- Simple fluid: anechoic
- Complex fluid: mixed echogenicity
- Synovitis:
 - Hypoechoic
 - Echogenic if gout
 - Possible hyperemia
- Stenosing

Rheumatoid Arthritis

19

Tenosynovitis: lupus

20

Tenosynovitis: rheumatoid arthritis

21

Extensor Tendon Sheath: wrist

- Axial plane
- Sagittal plane
- Largest anechoic fluid collection
 - Compressible
 - Flowing echoes

22

de Quervain Tenosynovitis

- Stenosing tenosynovitis
 - Overuse, primary care givers
- 1st dorsal wrist compartment:
 - Extensor pollicis brevis + abductor pollicis longus
- Ultrasound findings:
 - Thick synovial sheath
 - Tendinosis
 - Cortical irregularity, hyperemia

Pertinent Exam Findings:
What the #@!\$% are you doing to me? You're killing me!

J Ultrasound Med 1997; 16:685

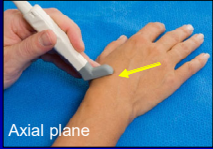
23

De Quervain's Tenosynovitis


24

De Quervain Tenosynovitis

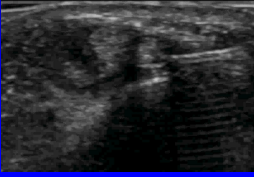
- Inject short axis: dorsal
- Between EPB & radius
- Possible septation
- Inject around both tendons
- Avoid superficial branch of radial nerve



Axial plane



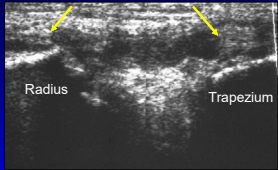
APL EPB



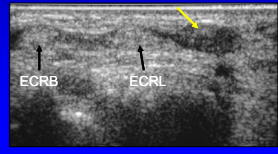
25

Tendon Tear

- Hypoechoic or anechoic
- Disruption of tendon fibers
- Retraction: full-thickness – Dynamic imaging



Radius Trapezium

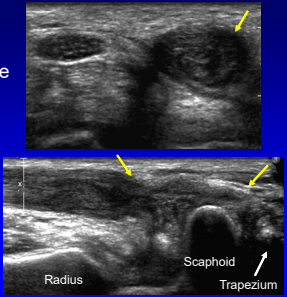


ECRB ECRL

26

Flexor Carpi Radialis

- Courses volar to triscaphe joint (scapho-trapezium-trapezoid compartment)
- FCR tendinosis and tear
- Associated triscaphe osteoarthritis

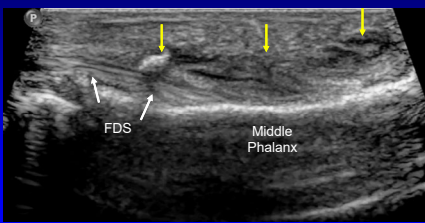


Radius Scaphoid Trapezium

Parellada et al. Skeletal Radiol 2006; 35:572

27

Flexor Digitorum Profundus Avulsion and Pulley A4 Tear



FDS Middle Phalanx

Long Axis

28

Pitfall Alert! Pseudo-tendon Tear

- Multiple tendon fascicles
- Abductor pollicis longus
 - Incidence: 80%
 - Up to 4 fascicles
- Extensor pollicis brevis
 - Incidence: 7%
 - Up to 2 fascicles
 - May be absent
- “Lotus Root Sign”
 - Seen best distal to radius



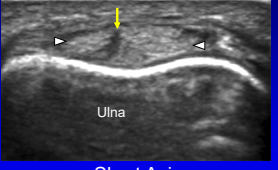



Rousset et al. Radiology 2010; 257:427
Choi et al. Radiology 2011; 260:480

29

Pitfall Alert! Pseud-tendon tear

- Extensor carpi ulnaris
- 6th extensor compartment
- Short axis: hypoechoic cleft
- Due to fibrovascular tissue in between two heads of extensor carpi ulnaris



Ulna

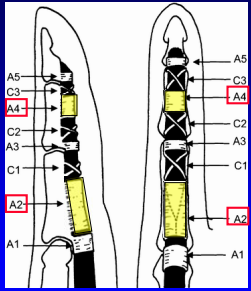
Short Axis

30

Pulley Tear

- A2 and A4 pulleys: most important
- Sagittal image
 - Bowstringing
 - Hypochoic edema / hemorrhage
- Dynamic evaluation*

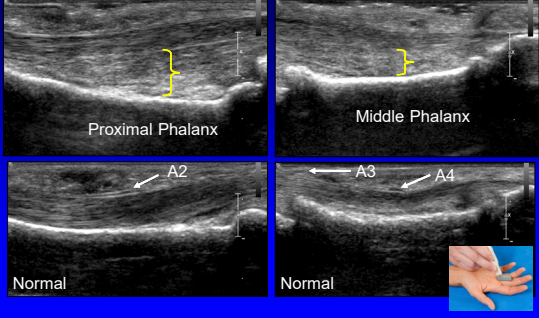
*Radiology 2002; 222:755



Radiology 1998; 206:339

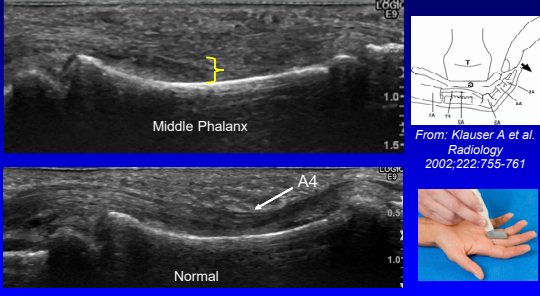
31

A2 – 4 Pulley Injury



32

A4 Pulley Injury: bowstringing



From: Klausner A et al. Radiology 2002;222:755-761

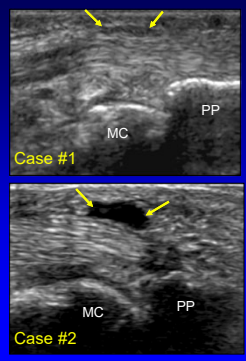
Normal: < 1 mm; incomplete rupture: 1 – 3 mm; complete: 3 mm

33

Trigger Finger

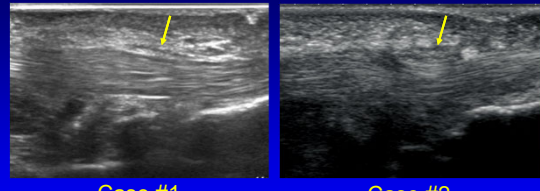
- Stenosing tenosynovitis: A1 pulley
- Thick and hypochoic pulley
- Hyperemia: 91%
- Tendinosis: 48%
- Tenosynovitis: 55%

Guerini et al. J Ultrasound Med 2008; 27:1407



34

Trigger Finger: thumb

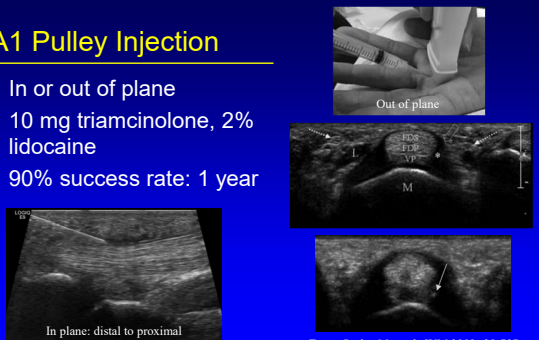


35

A1 Pulley Injection

- In or out of plane
- 10 mg triamcinolone, 2% lidocaine
- 90% success rate: 1 year

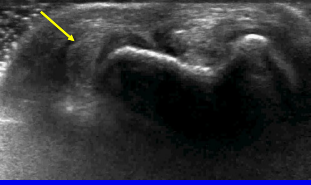
From: Bodor M, et al. JUM 2009; 28:737



36

Extensor Carpi Ulnaris

- 6th extensor wrist compartment
- Dislocation:
 - Dynamic
 - Supination/pronation
 - Subsheat tear or dysfunction
- Predisposes to tendon tear and tenosynovitis

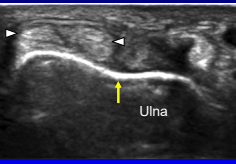


Campbell D et al. Br J Sports Med 2013; 47:1105

37

Pitfall Alert! Pseudo-subluxation

- Extensor carpi ulnaris
- 6th extensor wrist compartment
- Asymptomatic subluxation
 - Supination
 - Up to 50% out of groove
 - No tear or tenosynovitis



Lee KS et al. AJR 2009; 193:651

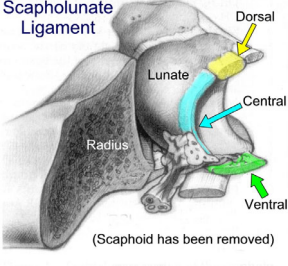
38

Pathology:

- Joint effusion and synovitis
- Tendon abnormalities
- Nerve entrapment
- Ligament, cartilage, and osseous injury
- Cysts and masses

39

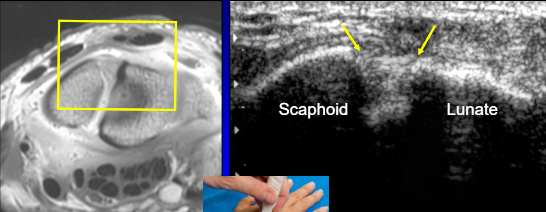
Scapholunate Ligament



From: Linkous MD, et al. Radiology 2000; 216:846

40

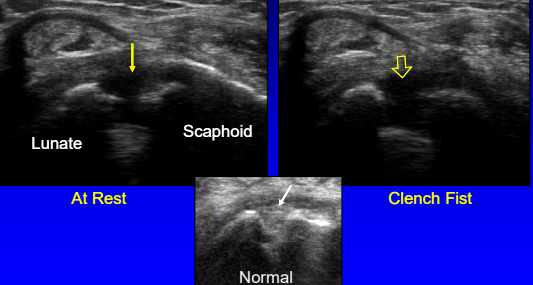
Dorsal Wrist: scapholunate ligament



Axial T1w Transverse

41

Scapholunate Ligament Tear



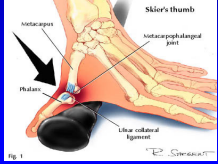
At Rest Clench Fist

Normal


42

Gamekeeper's or Skier's Thumb

- Injury: ulnar collateral ligament of first MCP joint
- Chronic (gamekeeper's thumb): historically in Scottish gamekeepers
- Acute (skier's thumb): acute hyperabduction



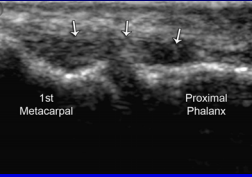
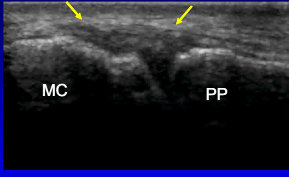
Acute Mechanism



Chronic Mechanism

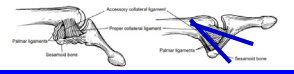
43

Ulnar Collateral Ligament: thumb






1st Metacarpal Proximal Phalanx MC PP

Note: sliding of adductor aponeurosis with isolated interphalangeal joint flexion



44

Ulnar Collateral Ligament: thumb


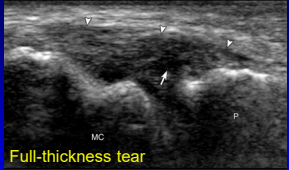
1 2 3 4 5

Normal Sprain Partial Tear Nondisplaced Complete Tear Displaced Complete Tear (Stener Lesion) (+ fracture)

Radiographics 2006;26:1007 **RadioGraphics**

45

UCL: tears

Partial-thickness tear Full-thickness tear

MC P MC P

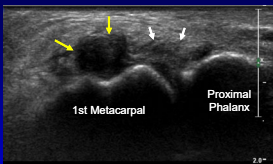

Normal

Teaching Point: 90% of UCL injuries are distal

46

Stener Lesion

- Displaced proximal stump of UCL
 - Hypochoic & round
 - Proximal to MCP joint
 - At proximal edge of adductor pollicis aponeurosis
- No tissue spanning MCP joint
- "Yo-yo on a string" sign
- Ultrasound: 100% accuracy

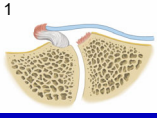
Yellow arrows: Stener
White arrows: aponeurosis

1st Metacarpal Proximal Phalanx

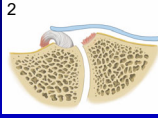
*Melville D. et al. Skeletal Radiology 2013; 42:667

47

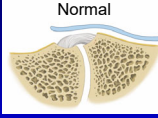
Stener Lesion: variations



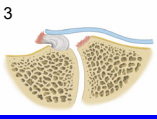
1



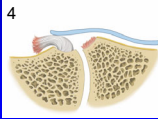
2



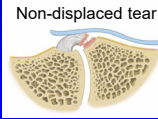
Normal



3



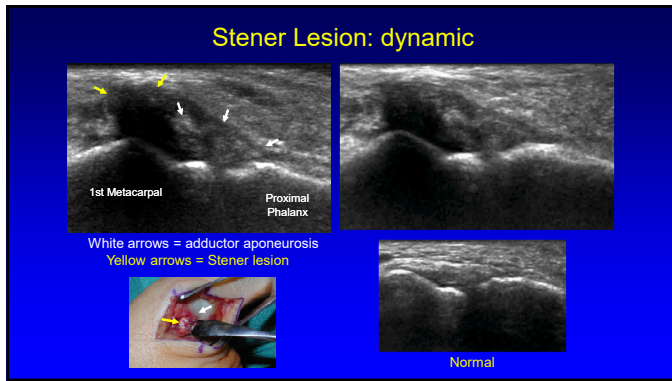
4



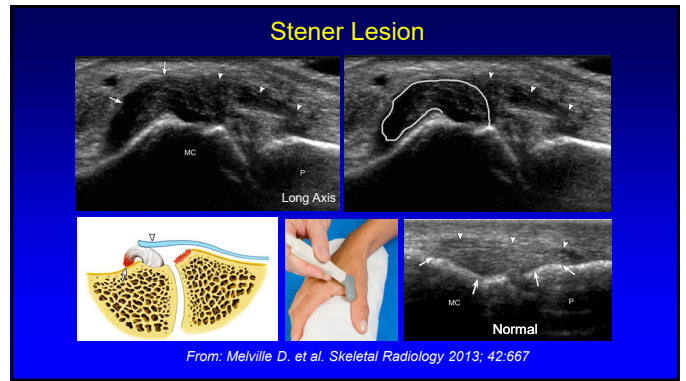
Non-displaced tear

Displaced Full-thickness Tears

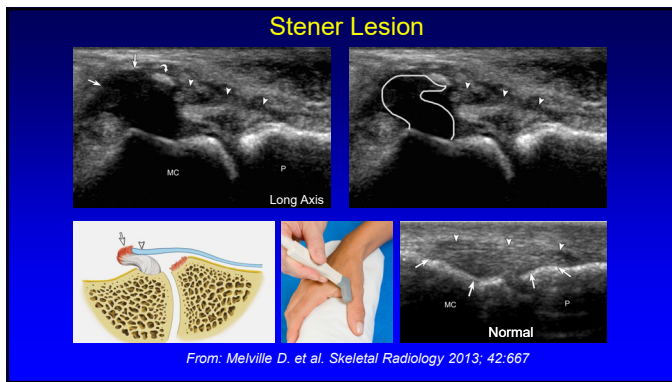
48



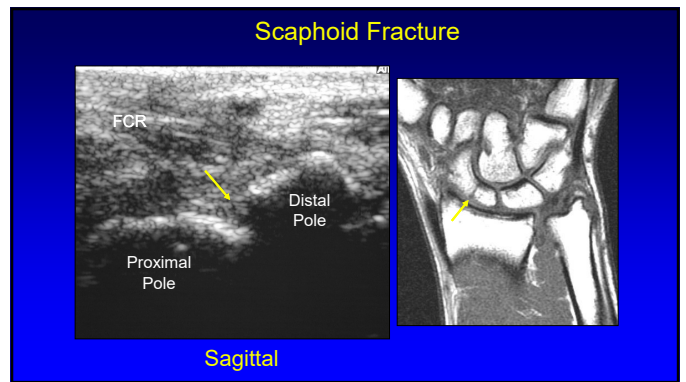
49



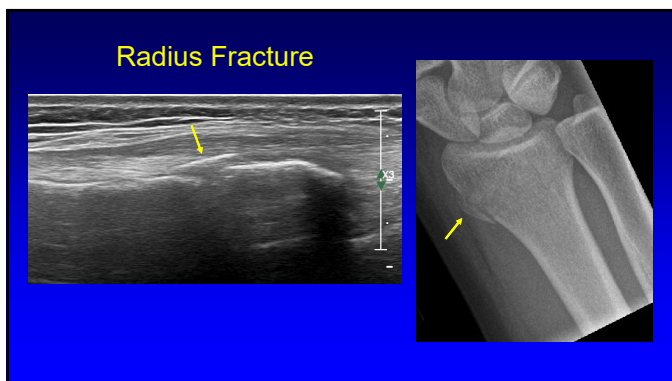
50



51



52



53

- ### Pathology:
- Joint effusion and synovitis
 - Tendon abnormalities
 - Nerve entrapment
 - Ligament, cartilage, and osseous injury
 - Cysts and masses

54

Ganglion: wrist

- Anechoic or hypoechoic
- Multilocular (except digits)
- Non-compressible
- Joint or tendon sheath communication
- <10 mm: hypoechoic without posterior acoustic enhancement

*Wang et al. J Ultrasound Med 2007; 26:1323

55

Ganglion Cyst vs Dorsal Recess

Ganglion: not compressible Recess: compressible

Sagittal with Wrist Flexion

56

Ganglion Cyst: volar

Flexor Carpi Radialis Radius Radial Artery

Axial color Doppler

57

Ganglion Cyst: volar

Axial T2w

58

Ganglion Cyst: dorsal + aspiration

Radius Lunate Capitate

Sagittal Transverse

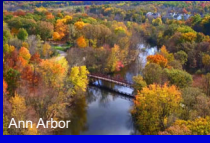
59

Take Home Points:

- Arthritis: emphasize synovitis
- Nerve: swelling at entrapment site
- Stener:
 - Proximal to MCP joint and aponeurosis
 - Dynamic imaging
- Ganglion cysts:
 - Volar at FCR and radial artery
 - Dorsal over SL ligament

60

Thank you!



Syllabus on line and other educational material:
www.jacobsonmskus.com

